Faculty of Resource Science and Technology

Distribution, Population Structure and Reproductive Biology of Nipa-Obligate Crab *Labuanium politum* in Western Part of Sarawak

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgement has been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

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ABSTRACT

Labuanium politum is a nipa-obligate arboreal crab and may be facing threats from human exploitation and habitat disturbance for socio-economic development in Sarawak. In addition, the ecology of this crab in their natural habitat are still unknown and it is crucial to balance the needs between resource utilisation and conservation. Therefore, this study was performed to i) document the distribution and population structure of *L. politum* at four nipa forest (NF) conditions based on human activity, ii) correlate selected environmental factors of NFs with *L. politum* population structure, iii) determine sexual maturity size (SM_{50}) of *L. politum* and iv) examine any form of parasitic infestation on *L. politum*. For the first objective, samplings were performed at selected NFs in three districts of Sarawak during daytime (15/04/2017–20/10/2018). The sites were then categorised into four conditions: i) managed NF, ii) managed NF with *L. politum* exploitation, iii) deforested NF and iv) undisturbed NF. It was observed that *L. politum* is not endemic since this crab were found from all NFs surveyed and majorities belong to 20–24 mm (28.39%) and 25–29 mm (31.17%) size classes while the minorities were recorded in 5–9 mm (1.23%), 10–14 mm (4.32%) and 35–39 mm (0.31%) size classes. Results showed that NF management via tree pruning seem to benefit *L. politum* populations which provide more green leaves and boost its food availability. In unmanaged nipa, the abundance of nipa palm tree was not affecting the *L. politum* population. For the second objective, the environmental parameters (total organic matter, sediment moisture, mud and air temperature and light penetration) at two different localities (Tambak and Tambirat) were measured simultaneously with crab collections for six month period (Jun-Aug 2017; Nov 2017-Jan 2018). Between localities, Tambak was significantly higher in mud temperature and light penetration, while Tambirat was significantly higher in sediment moisture. The carapace width (CW) ranged from 8.32–

33.64 mm (males) and 10.80–32.74 mm (females). The density and CW of *L. politum* were equal throughout sampling periods at each site and between both localities. Overall, Tambak samples dominated bigger CW size classes than Tambirat and males were dominating bigger CW size classes than the females but no sexual dimorphism was observed in the carapace shape. A significant negative correlation was observed between TOM and *L. politum* CW at Tambak, while other parameters were not correlated for both localities. However, this finding may not reflect the real case since the environmental parameters were not measured on daily basis. Based on the SM_{50}, Tambirat population achieved SM_{50} in smaller size (male = 17.54 mm, female = 20.27 mm) than Tambak population (male = 23.28 mm, female = 21.99 mm) which could be due to higher human exploitation pressure at Tambirat. Correspondance Analysis showed crabs with DE stage were closely associated in July and August (50%) for Tambak and June (<40%) for Tambirat, thus the ideal harvesting time suggested should be in July onwards. Furthermore, the ideal harvesting size limit set at 75% total maturation was approximately >23.00 mm (Tambirat) and >26.00 mm (Tambak). This study had newly discovered branchial bopyrid isopod *Leidya distorta* infesting *L. politum* in Southeast Asia region. Only female isopods of various stages were found harbouring the *L. politum*. Higher prevalence occurred at Tambirat (4.46%) than Tambak (2.41%) but this infestation did not show fully castration effect towards its host.

Keywords: Sesarmid crab, nipa management, crab population, resource management, isopod parasite

Taburan, Struktur Populasi dan Reproduktif Biologi Ketam Obligat-Nipah;* Labuanium politum *di Bahagian Barat Sarawak

ABSTRAK

Labuanium politum *adalah ketam pemanjat nipah dan menghadapi ancaman exploitasi manusia dan gangguan habitat untuk pembangunan sosio-ekonomi di Sarawak. Tambahan pula, ekologi* L. politum *di habitat semula jadi masih belum terungkai dan adalah sangat penting untuk mengimbangkan penggunaan sumber dengan pemuliharaan. Oleh itu, kajian ini dilakukan untuk i) mendokumentasikan taburan dan struktur populasi* L. politum *pada empat keadaan hutan nipa (HN) berdasarkan aktiviti manusia, ii) menghubungkan faktor persekitaran HN yang terpilih dengan struktur populasi* L. politum, *iii) menentukan saiz kematangan seksual (SM50)* L. politum *dan iv) mengkaji sebarang bentuk jangkitan parasit pada* L. politum. *Objektif pertama, penyelidikan dilakukan di tiga daerah di Sarawak pada waktu siang (15/04/2017–20/10/2018). HN ini kemudian dikategorikan kepada empat keadaan: i) HN yang terurus, ii) HN yang terurus dengan eksploitasi* L. politum, *iii) HN yang ditebang dan iv) HN yang tidak diganggu.* L. politum *tidak dikategorikan sebagai endemik kerana ia telah direkodkan di semua HN kajian dan majoriti lebar cangkerang (LC) tergolong dalam kelas saiz 20–24 mm (28.39%) dan 25–29 mm (31.17%) sementara minoriti dicatat dalam kelas saiz 5–9 mm (1,23%), 10–14 mm (4,32%) dan 35–39 mm (0,31%). Kajian menunjukkan bahawa pengurusan HN melalui penyantasan pokok nampaknya memberi manfaat kepada populasi* L. politum *yang menggalakkan pertumbuhan daun hijau dan meningkatkan ketersediaan makanan. Pada HN yang tidak diganggu, kepadatan nipah tidak mempengaruhi populasi* L. politum. *Objektif kedua, faktor persekitaran (bahan organik, kelembapan sedimen, suhu lumpur dan udara serta ketembusan cahaya) di dua lokasi yang berbeza (Tambak dan Tambirat) diukur serentak dengan pensampelan ketam*

selama enam bulan (Jun-Ogos 2017; Nov 2017-Jan 2018). Perbandingan antara kawasan, Tambak lebih tinggi untuk suhu lumpur dan ketembusan cahaya, sementara Tambirat lebih tinggi untuk kelembapan sedimen. LC adalah 8.32–33.64 mm (jantan) dan 10.80–32.74 mm (betina). Ketumpatan dan LC L. politum *adalah sama sepanjang tempoh penyelidikan di antara kedua-dua lokasi. Secara keseluruhan, sampel Tambak mendominasi kelas saiz LC yang lebih besar daripada Tambirat dan jantan mendominasi kelas ukuran LC yang lebih besar daripada betina tetapi tiada dimorfisme seksual ditunjukkan oleh bentuk cangkerang. Hubung kait negatif yang signifikan diperhatikan antara bahan organik dan LC L. politum di Tambak, manakala faktor lain tidak menunjukkan sebarang hubung kait. Namun, dapatan ini mungkin tidak menunjukkan keadaan sebenar kerana tempoh masa faktor persekitaran yang diukur adalah singkat. Berdasarkan* SM_{50}*, populasi Tambirat mencapai* SM_{50} *dalam ukuran yang lebih kecil (jantan=17.54 mm, betina=20.27 mm) daripada Tambak (jantan=23.28 mm, betina=21.99 mm) yang mungkin disebabkan oleh tekanan eksploitasi manusia yang lebih tinggi di Tambirat. Analisis korespondensi menunjukkan bilangan ketam matang penuh berkait rapat dengan bulan Julai dan Ogos (Tambak=50%) dan Jun (Tambirat=<40%). Oleh itu, masa penangkapan yang disarankan ialah pada bulan Julai dan seterusnya. Selanjutnya, had saiz tangkapan sesuai ditetapkan pada tahap 75% pematangan iaitu lingkungan >23.00 mm (Tambirat) dan >26.00 mm (Tambak). Kajian ini telah pertama kalinya merekodkan jangkitan isopod bopyrid* Leidya distorta *pada* L. politum *di rantau Asia Tenggara. Hanya isopod betina dari pelbagai peringkat dijumpai pada* L. politum. *Jangkitan lebih tinggi ditemui di Tambirat (4.46%) berbanding Tambak (2.41%) namun jangkitan tidak mengakibatkan kemandulan sepenuhnya terhadap ketam.*

Kata kunci: *Ketam sesarmid, pengurusan nipah, populasi ketam, pengurusan sumber, parasit isopod*

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